

Proceedings of the Zakopane School of Physics 2023  
International Symposium  
Breaking Frontiers: Submicron Structures  
in Physics and Biology

Zakopane, Poland, May 23–27, 2023



*Editors of the Proceedings:*

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POLISH ACADEMY OF SCIENCES  
INSTITUTE OF PHYSICS

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# Preface

The Zakopane School of Physics “Breaking Frontiers: Submicron Structures in Physics and Biology” was held in Zakopane, Poland, from 23 to 27 of May 2023. This conference is a recurrent event of an international range, organized since the mid-1960s and encompassing a wide scope of scientific problems related not only to novel measurement techniques, but also to the application of nuclear physics methods in the study of biomedical materials and condensed phase.

The School is directed to early career scientists: students, Ph.D. students, and adjuncts at the threshold of the scientific career, who can present the results of their work or consult experienced mentors in a pleasant atmosphere. Among the 80 participants, 19 leading specialists in material science, physics, and biology enriched the event with their insightful lectures. The subject matter of this year’s meeting included: the applications of novel X-ray techniques, multifunctional materials, magnetic nanostructures, molecular magnets, and the applications of physics in biology and medicine. Two special sessions were organized as part of the event: the first one devoted to measurement possibilities with the use of the X-ray laser in Hamburg (European XFEL), and the second one to the ELI (Extreme Light Infrastructure) research infrastructure.

In addition to the formal scientific program, the School allocated time for informal meetings and discussions, fostering collaboration and the birth of new ideas and friendships. As in previous meetings, valuable conversations and exchanges of opinions took place during scientific sessions, excursions, and shared meals and coffee breaks.

The success of the School was a collective effort. Special acknowledgment goes to the International Advisory Board for its significant input and constructive feedback. The Local Organizing Committee played a crucial role in preparing the conference, and I would like to thank you for your determination, commitment, and patience. Sincere thanks are also extended to all speakers and chairpersons for maintaining session schedules while encouraging lively debates. Gratitude is also expressed to the guest editors, authors, and referees for their dedicated efforts in ensuring that the proceedings accurately reflect the presented content. Special appreciation is reserved for Professor Jan Mostowski for his understanding, assistance, and support in preparing these proceedings.

The ongoing success of this symposia series fills me with optimism and eager anticipation for the forthcoming event in 2025. I hope that the Zakopane School of Physics 2023 has made a meaningful contribution to fostering relationships within the community engaged in interdisciplinary research, transcending the traditional boundaries of physics and biology.

Magdalena Fitta  
*Chair of the Conference*

## List of invited speakers

<b>Siham Benhabib</b> (Gif-sur-Yvette)	“Photo-induced phenomena in quantum materials”
<b>Claudio Cirelli</b> (Villigen)	“Ultrafast X-ray science at SwissFEL Alvrá”
<b>Péter Dombi</b> (Budapest)	“Ultrasensitive optical probing of plasmonic hot electrons”
<b>Alicia Forment-Aliaga</b> (Valencia)	“Spin-crossover effect meets 2D materials and chirality”
<b>Jakub Jurczyk</b> (Zaragoza)	“3D nanolithography methods for novel spintronic devices”
<b>Katarzyna Majzner</b> (Kraków)	“Spectrophenotyping of leukemia cells — from Raman imaging to diagnosis”
<b>Denys Makarov</b> (Dresden)	“Curvilinear magnetism — from fundamentals to applications”
<b>Ioanna Mantouvalou</b> (Berlin)	“Transient NEXAFS spectroscopy using a laser-produced plasma soft X-ray source”
<b>Mark W. Meisel</b> (Gainesville)	“Materials in metastable forms — molecules to metals”
<b>Christopher Milne</b> (Schenefeld)	“Probing ultrafast structural and electronic dynamics in chemistry, biology and materials research using X-ray free electron lasers”
<b>Michael Meyer</b> (Schenefeld)	“Multi-photon processes and molecular dynamics in the soft X-ray regime: The small quantum systems (SQS) instrument at the European XFEL”
<b>Beata Nowicka</b> (Kraków)	“Thin films and nanocomposites of switchable coordination polymers”
<b>Bohdan Padlyak</b> (Zielona Góra)	“EPR spectroscopy of the radiation-induced centres in borate glasses”
<b>Przemysław Piekarczyk</b> (Kraków)	“Theoretical study of the demagnetization process in magnetic multilayers under ultrafast X-ray irradiation”
<b>Dawid Pinkowicz</b> (Kraków)	“Bringing molecular photomagnets to light — photochemical approach to molecular photomagnets”
<b>Alessandro Surrente</b> (Wrocław)	“Magnetically brightened dark excitons in two-dimensional metal halide perovskite nanoplatelets”
<b>Cristian Svetina</b> (Madrid)	“Extension of four wave-mixing methods at short wavelengths”
<b>Jakub Szlachetko</b> (Kraków)	“SOLARIS National Synchrotron Radiation Centre: The infrastructure for research and industry”
<b>Wojciech Tabiś</b> (Kraków)	“Exploring high magnetic field facilities: Advancements, challenges, and applications”

